

CLAIMS

Now, therefore, the following is claimed:

- 1 1. An immunological assay system, comprising:
 - 2 a filter vessel capable of containing an assay sample;
 - 3 an incubator in which the filter vessel may be placed, wherein the incubator
 - 4 houses the filter vessel while the assay sample and one or more reagents react;
 - 5 a sample separation system in close proximity to the incubator, wherein the
 - 6 sample separation system is designed to separate the assay sample and the reagents into
 - 7 various components;
 - 8 an image acquisition system in close proximity to the sample separation system,
 - 9 wherein the image acquisition system is designed to detect the presence of interactions
 - 10 between the components and reagents of the assay mixture; and
 - 11 a robotic pipettor including a robotic arm within reaching distance of the filter
 - 12 vessel, the incubator, the sample separation system and the image acquisition system,
 - 13 wherein the robotic pipettor is designed to transfer the sample or the reagents between the
 - 14 filter vessel, incubator, the sample separation system and the image acquisition system.
- 1 2. The system of claim 1, further comprising a washer, wherein the washer is
 - 2 designed to wash the assay sample while the sample is disposed within the filter vessel.
- 1 3. The system of claim 1, wherein the filter vessel comprises a filter including an
 - 2 inert material including a plurality of pores.
- 1 4. The system of claim 3, wherein the filter vessel is configured to hold an assay
 - 2 sample such that the sample comes into contact with the filter material.
- 1 5. The system of claim 3, wherein the pores of the filter material comprise a size
 - 2 between approximately 0.01 micron and approximately 50 microns.

- 1 6. The system of claim 3, wherein the filter material has a thickness between
2 approximately three microns and approximately five millimeters.

- 1 7. The system of claim 3, wherein the filter material is selected from the group
2 consisting of: polyester mesh, nylon mesh, polycarbonate track-etched membrane,
3 cellulose acetate membrane, and polyvinylidene difluoride filter membrane.

- 1 8. The system of claim 1, wherein the sample separation system is a centrifuge.

- 1 9. The system of claim 1, wherein the sample separation system is a vacuum system.

- 1 10. The system of claim 1, wherein the image acquisition system is a flow cytometer.

- 1 11. The system of claim 1, wherein the image acquisition system is a camera.

- 1 12. An immunological assay method comprising the steps of:
2 incubating an immunological sample and reagent mixture in a filter vessel;
3 separating the sample and reagent mixture in the filter vessel into components
4 above and below a filter; and
5 analyzing the components above or below, or both above and below, the filter in
6 the filter vessel to determine the presence of interactions between the components.

- 1 13. The method of claim 12, further comprising the step of transferring the filter
2 vessel to a turntable mechanism after the separating step, but before the analyzing step.

1 14. The method of claim 12, further comprising:
 2 a first step of placing a sample in a filter vessel, wherein the sample comprises
 3 cellular components;
 4 a second step of adding antibody reagents to the sample; and
 5 wherein the step of separating the sample and reagent mixture comprises
 6 separating the sample mixture into cellular components and liquid components, and
 7 wherein the step of analyzing the filter vessel comprises analyzing the cellular
 8 components that remain above the filter.

1 15. The method of claim 12, further comprising:
 2 a first step of placing a sample in a filter vessel, wherein the sample comprises
 3 antibody containing samples such as plasma or serum;
 4 a second step of adding antigen carrier reagents, such as red blood cells or
 5 synthetic beads, to the antibody containing sample; and
 6 wherein the step of separating the sample and reagent mixture comprises
 7 separating the sample mixture into antigen carrier components and liquid components,
 8 and
 9 wherein the step of analyzing the filter vessel comprises analyzing the antigen
 10 carrier components that remain above the filter.

1 16. The method of claim 15, wherein the step of analyzing the filter vessel produces
2 unclear results, and further comprising the steps of:

3 separating the antigen carrier components from the liquid components by
4 capturing the antigen carrier components above the filter in the filter vessel;
5 washing the components above the filter with a physiological salt solution;
6 separating the antigen carrier components from the liquid components;
7 adding antibody reagents to the washed antigen carrier components remaining
8 above the filter in the filter vessel;
9 incubating the antigen carrier components and the antibody reagents in the filter
10 vessel;
11 separating the sample and reagent mixture in the filter vessel into components
12 above and below the filter;
13 washing the antigen carrier components above the filter with a physiological salt
14 solution; and
15 analyzing the components above or below the filter in the filter vessel to
16 determine the presence of interactions between the components.

1 17. The method of claim 16, wherein the washing step comprises the steps of:

2 providing a physiological salt solution selected from the group consisting of
3 saline, phosphate buffered saline and other physiological salt solutions which preserve the
4 viability of the cellular components during the assay;
5 adding between approximately 10 microliters to approximately 5 milliliters of the
6 physiological salt solution the sample;
7 separating the sample into the antigen carrier components remaining above the
8 filter from the liquid components below the filter; and
9 repeating the adding and separating steps from one to approximately ten times.

1 18. The method of claim 12, wherein the step of placing an immunologic assay
2 sample in a filter vessel comprises placing an immunologic assay sample in a filter vessel
3 comprising a filter including an inert material including a plurality of pores.

1 19. The method of claim 12, wherein the step of separating the sample and reagent
2 mixture in the filter vessel into components above and below the filter comprises the step
3 of separating the sample and reagent mixture with a centrifugation system.

1 20. The method of claim 19, wherein the step of separating the sample and reagent
2 mixture with a centrifugation system comprises separating the sample and reagent
3 mixture with a centrifugation system operating at a speed between approximately 10 X g
4 and approximately 10,000 X g.

1 21. The method of claim 19, wherein the step of separating the sample and reagent
2 mixture with a centrifugation system comprises separating the sample and reagent
3 mixture with a centrifugation system operating for a time between approximately five
4 seconds and approximately five minutes.

1 22. The method of claim 12, wherein the step of separating the sample and reagent
2 mixture in the filter vessel into components above and below the filter comprises the step
3 of separating the sample and reagent mixture with a vacuum system.

1 23. The method of claim 22, wherein the step of separating the sample and reagent
2 mixture with a vacuum system comprises separating the sample and reagent mixture with
3 a vacuum system operating at a pressure of between approximately - 0.1 inches Hg to
4 approximately - 100 inches Hg.

1 24. The method of claim 12, wherein the step of analyzing the components above or
2 below the filter comprises analyzing the components with a flow cytometer.

- 1 25. An immunological assay system comprising:
 2 a filter means;
 3 means for incubating a sample and reagent mixture in the filter means;
 4 means for separating the sample and reagent mixture in the filter means into
 5 components above and below a filter; and
 6 means for analyzing the components above or below, or both above and below the
 7 filter to determine the presence of interactions between the sample and the reagent.
- 1 26. The system of claim 25, wherein the filter means is a filter vessel.
- 1 27. The system of claim 25, wherein the means for separating the sample and reagent
 2 mixture is a centrifuge.
- 1 28. The system of claim 25, wherein the means for separating the sample and reagent
 2 mixture is a vacuum system.
- 1 29. The system of claim 25, wherein the means for analyzing the components above
 2 or below, or both above and below the filter is a flow cytometer.